

in Missouri. This caused the Missouri below the mouth of the Osage to rise rapidly during the latter part of the month, but the highest marks reached were considerably below flood stage and no damage was done.

TORNADO OF MARCH 23, 1913, AT OMAHA, NEBR.

Notes by L. A. WELSH, Local Forecaster, United States Weather Bureau, Omaha, Nebr.

The tornado that passed through the city of Omaha on the evening of Easter Sunday, March 23, 1913, was undoubtedly the most destructive to life and property that ever occurred in this portion of the country. The storm, attended by the pendant, funnel-shaped cloud, first struck the city at its southwest limit, Fifty-fourth and Frances Streets, and its track extended from that point in a northeasterly direction across the western and northern portions of the city to Cutoff Lake, which is near the Missouri River and in the extreme northeastern part of Omaha. The length of the path between the points named was about 5 miles, and its width, in the line of destruction across the city, varied from about one-fifth to one-fourth of a mile. The length of time consumed in the passage of the storm can not be ascertained exactly, but it is believed to have been about 12 minutes. The funnel-shaped cloud crossed Fortieth and Farnum Streets at 5.49 p. m., and Twenty-fourth and Lake Streets at 5.55 p. m., having traveled slightly more than 2 miles during that interval. The distribution of the wreckage and debris leaves unmistakable evidence of rotary winds, and the presence of a whirl in the cloud was noted at the points where the greatest destruction occurred. This was particularly the case at the Sacred Heart Convent, at Thirty-sixth and Burt Streets, in Bemis Park, and at Twenty-fourth and Lake Streets. At other points along the path, in the more open places, the wreckage lay in a general direction coincident with the path; that is, from southwest to northeast. A terrific grinding, roaring noise, that was heard distinctly several blocks distant, accompanied the storm.

The total number of persons killed in Omaha was 94; this includes those instantly killed and those who have died since from injuries received. The number of persons seriously and slightly injured will run into the hundreds. The greatest number of persons killed in any one locality was in the vicinity of Twenty-fourth and Lake Streets, that section being the most thickly populated; the houses there were of poorer construction and most of them were completely demolished. The animals killed were 33 horses, 4 cows, and 5 mules. The houses completely demolished numbered 600; those partially destroyed or badly damaged numbered 1,129. The estimated property loss, including homes, furniture, personal property, wiring, poles, street cars, trees, fences, etc., is about \$3,500,000.

The following meteorological conditions were noted in connection with the passage of the storm. The station where the observations were made is southeast of and about $1\frac{1}{2}$ miles distant from the nearest point within the path of the tornado. The barometer, which had begun to fall on the 22d, continued to fall steadily during the day up to the moment of the passage of the storm; the pressure then began to increase rapidly, with marked fluctuations in its upward movement. At 7 a. m. the reading was 28.51 inches, at noon 28.36, at 4 p. m. 28.17, and the lowest was 27.93 inches. At 7 p. m. the pressure had increased to 28.12 inches. At 7 a. m. the temperature was 40°; it rose until 4 p. m., when the highest for the

day, 68°, was reached. The sky was overcast with strato-cumulus clouds from the early morning until the middle of the afternoon, when for an hour or so it was only partly obscured. About 4.30 p. m. the sky again became overcast and grew more and more threatening in appearance until the storm, approaching from the southwest, burst upon the city. At 5.10 p. m. distant thunder was heard and rain began to fall and was heavy at intervals; the rain ended at 7.35 p. m. Small hailstones fell with the rain from 5.40 p. m. to 5.50 p. m. The prevailing wind for several hours preceding the storm was from the south, but for a period of 15 minutes before the storm struck it became changeable, with increasing velocity, and blew from all directions, but the general direction maintained during the passage of the tornado was southwest. The extreme velocity of the wind recorded at the station during the storm was 34 miles an hour; it occurred at 6.17 p. m.

Notes made at Creighton University, Twenty-fifth and California Streets, eight blocks from the tornado's path, by Prof. A. R. SCHMITT, S. J., who for a number of years has been a student and an investigator of meteorology.

As we are situated very high here at the college and have a full view of the entire horizon, except toward the southeast, my position was a very advantageous one. My attention was first called to the gathering of a storm at 4.30 p. m., when the cirrus sheet, which was spreading across the sky from west to east, obscured the sun. The wind at the time was blowing briskly from the southwest, probably 30 miles an hour. By 5 o'clock the cirrus covered two-thirds of the sky and a few scattered fracto-cumuli were scudding at a moderate altitude from southwest to northeast. At about 5.10 p. m. a light rain began to fall, the wind steadily increasing, and after this there was considerable play of lightning among the clouds, accompanied by an almost constant rumble of light thunder. (This thunder was afterwards said by some to have been the distant roar of the tornado.) There were, however, as far as I observed, no passages of lightning between the clouds and the earth at any time before the tornado had passed. At approximately 5.30 the clouds had lifted from the horizon everywhere except for a very short stretch in the southwest. This last fact, the peculiar color of the clouds—a muddy buff—and the time of day led me to suspect the approach of a tornado, but it was hardly more than a passing thought. The season seemed too early for such phenomena in this latitude; the wind was strong when I thought there should have been a comparative calm, and it did not veer in the least, as far as I could judge from the smoke; it had not been unusually sultry or warm for the end of March; these considerations led me to abandon the idea and I returned to my desk. Many times since I have upbraided myself for taking my eyes off that narrow black strip on the southwestern horizon, for it was the top of the funnel cloud, and for not getting my camera ready. A quarter of an hour or so later the pronounced strengthening of the wind, the pelting of light hail at my windows, and the flickering of the electric light brought me out once more. The clouds overhead were flying at a surprising rate and extremely low, but had no gyratory motion.

When I reached a corridor window from which I could get a full view of the western horizon, there was the funnel cloud coming down the hill southwest of us, at about Fortieth Street, only a half mile distant. I looked at my watch—it was just 5.49. In front the funnel was sharply defined, even to the very ground, and its circulation, counter-clockwise, upward and extremely violent,

was easily discernible. On either side, however, and in the rear rolling clouds of dust and vapor hid the outlines of the funnel. I could see telegraph poles and trees snap off just in front of the funnel, and large planks, portions of roofs, etc., were tossed about hundreds of feet in the air. The crashing of timber and masonry and the blast of the wind created a deafening roar. Under the erroneous impression that it is the speed of the forward progress of the tornado upon which the amount of damage depends, it has been estimated in press dispatches that the "twister" must have moved at a rate of not less than 75 miles an hour. My own estimate, made by timing the progress of the funnel for a distance of 1 block, is that it was going at the rate of 40 feet a second, or slightly less than 30 miles an hour. It was just 5.49 when I first saw the cloud at about Fortieth and Farnum Streets, and it was 5.55 when it crossed Twenty-fourth Street. Three of us who saw the tornado were all thoroughly surprised at the deliberation of the storm. It did not sweep across the city; there was no haste; it went at its appointed task carefully, taking its own time to churn up the path laid out for it. The lower extremity dragged considerably behind the rest of the cloud. It was rather dark immediately in front of the funnel, but surprisingly light outside the path. The clouds above us hung very low and rushed by at great speed, but showed no gyratory motion. Immediately behind the storm the sky was clear up to the cirrus sheet. Above the funnel the cumulonimbus was banked mountain high—much higher than I have ever seen it after the passage of a severe thunder storm. Below, long streamers of mist hung down almost to the ground. At the same time the clouds over Council

Bluffs had a similar appearance. There was very little rain while the cloud was passing, and just as little lightning.

Strangely or not, though we were within half a mile of the storm's path, the wind did not blow more than about 45 miles an hour here at the college. After about a quarter of an hour it became very dark and we had a violent thunderstorm, with a heavy fall of rain. As usual in the case of storms of this character, the people outside the immediate vicinity of the storm's path were ignorant for hours that anything disastrous had occurred.

There were a few isolated fires during the night, all in buildings previously wrecked by the storm. Monday morning and afternoon I went over the entire path of the storm, from one end of the city to the other, and secured a few pictures. After this trip I came to the conclusion that the tornado was one of only moderate intensity, far less severe, certainly, than the St. Louis storm of 1896. With few exceptions all the buildings wrecked were frame structures, fully three-fourths of them small cottages. The larger brick structures suffered only the loss of their roofs or small portions of the upper story walls. The Sacred Heart Convent is not the total wreck it was reported to be by outside papers, and the sisters are again living in the central part; and that story about a cottage being hurled through the air against the convent is purely a bit of wild fiction. Some of the stories about the tornado which have reached us through the papers of other cities are ludicrous indeed. Many escapes were miraculous, however; in the majority of cases those who sought refuge in the cellars of frame houses escaped with their lives. In some instances they found nothing but the sky overhead after the passage of the storm.